Project Report: Young Stellar Activity & Early Solar System Heating

Project Investigator:	***Bo Reipurth***

Project Progress

Bo Reipurth has been working on eruptive events in young Solar−like stars, the so called FUor and EXor eruptions. Observations of the prototype eruptive variable, FU Orionis itself, with the 8m Subaru telescope at Mauna Kea, has revealed that a nearby star is in fact a physical companion with characteristics similar to the T Tauri stars. Reipurth and co−worker Colin Aspin of the Gemini Observatory have proposed a new model for the onset of FUor eruptions, in which the disruption of a small multiple protostellar system leads to the formation of a binary star and triggering of large−scale disk instabilities. Such events are important not only for the growth it provides to the young star, but also for processes of irradiation of disk material, which may give clues to the short−lived intense heating events that affected chondrites and aqueous alteration products in the early solar system. As luck would have it, a major accretion event in a young star was discovered in January, 2004, by amateur astronomer Jay McNeil in the constellation Orion, and confirmed by University of Hawaii (UH) NAI associates K. Meech and J. Pittichova. This is the first major eruptive event since 1970, and it triggered a wealth of new observations around the world. Reipurth and Aspin's observations at the Mauna Kea observatory confirmed that McNeil's nebula is the result of a major eruptive event in a newborn star at the base of the nebula (see figure). The event represents a major flare−up in a circumstellar disk, reminiscent of events when our own Solar system was young.

The fact that McNeil's nebula was discovered by an amateur indicates that the community of professional astronomers do not have a sufficient capability to monitor the sky, and Reipurth has therefore embarked on an ambitious project, constructing two 16−inch fully automated telescopes, one to be located at the Haleakala Observatory in Hawaii for the northern sky, and the other at Cerro Tololo in Chile for the southern sky. These telescopes will monitor all of the nearest star forming regions, producing a vast catalogue of observations of temporal phenomena in the evolution of young stars as they approach adulthood.

Figure 1. In January 2004 amateur astronomer Jay McNeil discovered a new nebula in the constellation Orion. Observations at the Mauna Kea observatory showed that the nebula is the result of a major eruptive event in a newborn star at the base of the nebula. The event represents a major flare−up in a circumstellar disk, which eventually may turn into a planetary system. Such events are important for studies of irradiation of meteorites when our own Solar system was young. The figure, courtesy the Gemini Observatories, shows McNeil's nebula observed with the 8m Gemini telescope on Mauna Kea.

Highlights

- The discovery and subsequent follow up of a discovery of a major accretion event and flare up in a young circumstellar disk has lead to the development of a new model for the onset of these events. This has important implications for short−lived heating events in early solar systems that might contribute to chondrule formation and aqueous alteration of early solar system material.
- The development of two 16−inch telescopes, one for Hawaii and one for Cerro Tololo Interamerican Observatory in Chile, has begun in order to do all−sky monitoring of star forming regions to create temporal catalogs of the variability of young stars.

Roadmap Objectives

- ***Objective No. 3.1:*** Sources of prebiotic materials and catalysts